

**Chapter 9: Education, Training, and Outreach**

“Understand this is not just a job for politicians. So I'm going to need all of you to educate your classmates, your colleagues, your parents, your friends. Tell them what's at stake. Speak up at town halls, church groups, PTA meetings. Push back on misinformation. Speak up for the facts. Broaden the circle of those who are willing to stand up for our future.”<sup>1</sup>

In 2012, the U.S. Global Change Research Program (USGCRP) expanded its mission statement to include education as a critical component of the nation's response to global change. This new mission articulates USGCRP's role in addressing the mandated scope of the Global Change Research Act of 1990 over the next decade: “To build a knowledge base that informs human responses to climate and global change through coordinated and integrated Federal programs of research, education, communication, and decision support.” The resulting USGCRP strategic plan emphasizes better integration of social, ecological, and physical sciences to understand changing conditions, increased utilization of scientific information and knowledge, and better communication and education (USGCRP 2012b).

The increased strategic focus of the federal government and its partners with climate change communication and education programs in the United States seeks to promote a deeper understanding of the science of climate change, behavior change, and stewardship, and to support informed decision making by individuals, organizations, and institutions—all of which are summarized under the term

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<sup>1</sup> President Barack Obama's speech at Georgetown University announcing his new climate change policy, June 25, 2013. See <http://www.georgetown.edu/landing/1242711958096.html>.

1 “climate literacy.”<sup>2</sup> The ultimate goal of climate literacy is to enable individuals, businesses, and  
2 communities to address climate change, in terms of stabilizing and reducing emissions of greenhouse  
3 gases (GHGs), and also increasing capacity to adapt to and prepare for the consequences of climate  
4 change.

5  
6 U.S. educational efforts focus on three distinct, but related, areas: the science of climate change, the  
7 human–climate interaction, and using climate education to promote behavioral change. Each of these  
8 approaches is represented in the Atlas of Science Literacy (AAAS and NSTA 2007) and in the conceptual  
9 framework for science education developed at the National Research Council (NRC) in 2011 (Quinn et al.  
10 2013). These approaches also informed the development of the Next Generation Science Standards—an  
11 innovative way to address climate change education within the decentralized U.S. education system (NAS  
12 et al. 2013).

13  
14 Climate change communication faces many challenges, but federal agencies, civil society, and individuals  
15 have invested in numerous initiatives to develop a climate-literate citizenry and skilled workforce. The  
16 authors of *America’s Climate Choices*, found that although “climate change is difficult to communicate  
17 by its very nature, ... education and communication are among the most powerful tools the nation has to  
18 bring hidden hazards to public attention, understanding, and action” (NRC 2011).

19  
20 Numerous federal agencies, nongovernmental organizations (NGOs), and individuals have supported  
21 sustained and robust educational and communication initiatives to harness these tools. When citizens have  
22 knowledge of the causes, likelihood, and severity of climate impacts, as well as of the range, cost, and  
23 efficacy of options to adapt to impacts, they are more prepared to effectively address the risks and

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<sup>2</sup> See <http://www.climate.gov/teaching/teaching-climate-literacy-and-energy-awareness>.

opportunities of climate change. Furthermore, since 2010, more Americans than ever before experienced the impacts of climate change first-hand in the form of extreme events—such as Superstorm Sandy and prolonged drought—resulting in increased public interest in and an opportunity for engagement on climate literacy issues.

## **UPDATES SINCE THE 2010 U.S. *CLIMATE ACTION REPORT***

Climate change education, training, and outreach efforts have matured significantly since the *U.S. Climate Action Report 2010* (2010 CAR) (U.S. DOS 2010), even in a recently constrained budgetary environment. Since the 2010 CAR, federal programs that support formal educational initiatives on climate change have begun to develop a coordinated national network of regionally or thematically based partnerships devoted to increasing the adoption of effective, high-quality educational programs and resources related to the science of climate change and its impacts. These programs involve kindergarten through grade 12 (K–12) and undergraduate curricula and postgraduate professional development programs, as well as informal education programs conducted in museums, parks, nature centers, zoos, and aquariums across the country.

### **Federal Programmatic Coordination**

Federal agencies coordinate climate change educational efforts through USGCRP and other cross-cutting initiatives. USGCRP, which coordinates and integrates climate research across 13 government agencies, included education in its 10-year strategic plan (USGCRP 2012b). USGCRP committed its focus over the next decade not only to encouraging greater public understanding of the science through the dissemination of relevant, timely, and credible global change information, but also to gaining further understanding of the public's science and information needs through engagement and dialogue. This two-pronged approach will help ensure decision makers at all levels have the capacity to make informed decisions. This strategy is being implemented through the integration of communication, education, and engagement into core USGCRP activities.

As the leading federal authority on global change science, USGCRP, together with its member agencies, is uniquely positioned to serve as the gateway to global change information for the nation, and has taken a leadership role in the development of the scientific workforce of the future. Many other federal agencies, such as the U.S. Environmental Protection Agency (EPA), National Park Service (NPS), the National

1 Oceanic and Atmospheric Administration (NOAA), National Institute of Food and Agriculture (NIFA),  
2 also have the capacity to communicate with citizens on specific aspects of global change related to their  
3 respective missions. Many of these US federal agencies have supported education institutions in  
4 developing a pipeline of the scientific workforce relevant to global change.

5 While individual agency actions are important, and the contributions in the aggregate are significant, one  
6 of the greatest strengths of USGCRP is its ability to develop synergies across federal agencies to  
7 coordinate efforts in communication and education. The USGCRP strategy for communication, education,  
8 and engagement efforts over the next decade will build on the strengths of the participating agencies.  
9 USGCRP will coordinate the development of multi-agency products and programs, grow and expand the  
10 reach of information beyond single agencies, and ensure that feedback and input from public engagement  
11 is shared broadly within the federal global change science community.

12  
13 The coordination in climate change communication and education across the federal departments and  
14 programs contained in the 2010 CAR has continued through the USGCRP Communication and Education  
15 Interagency Working Group. This group develops a national climate and climate change education  
16 communication strategy that is inclusive of all USGCRP members, and coordinates climate education,  
17 communication, and engagement activities and priorities across the USGCRP members.

18  
19 For example, one effort led by the National Science Foundation (NSF), the National Aeronautics and  
20 Space Administration (NASA), and NOAA was the Tri-Agency Climate Change Education grant  
21 coordination effort.<sup>3</sup> In another example, discussions among the National Science Foundation (NSF),

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<sup>3</sup> See [http://gcce.larc.nasa.gov/trace/trace\\_catalog.php](http://gcce.larc.nasa.gov/trace/trace_catalog.php) and [https://nice.larc.nasa.gov/tri\\_pi/](https://nice.larc.nasa.gov/tri_pi/).

NOAA, NIFA, EPA, and NASA in 2009 led to the development of the NSF Climate Change Education Partnership (CCEP) Program—a program that develops transdisciplinary collaborations among climate scientists, learning scientists, and education practitioners working in formal and informal learning environments, discussed in more detail below.

### **Sample Partnerships in Climate Change Education**

In fiscal year (FY) 2010, NSF launched an innovative science education program focused on educating students, teachers, and the public about global climate change and its impacts. Structured as a two-phase competition, the Climate Change Education Partnership (CCEP) program established new transdisciplinary collaborations among climate scientists, learning scientists, and education practitioners working in formal and informal learning environments. Numerous federal agencies partner with these NSF-funded projects, including NASA, NOAA, and the U.S. Department of the Interior (DOI). The following initiatives are examples of federal partnerships in climate change education.

### **Climate Literacy Zoo Education Network**

The NSF-funded Climate Literacy Zoo Education Network (CLiZEN) highlights some of the important results of CCEP. The overarching purpose of CLiZEN was to develop and evaluate a new approach to climate change education that connects zoo visitors to polar animals currently endangered by climate change, leveraging the associative and affective pathways known to dominate the general public's decision making. CLiZEN built on interagency PI meetings, and the NOAA-funded research on American attitudes about the ocean and climate change (Boyle and Mott 2009)..

Utilizing a polar theme, the network brings together a strong multidisciplinary team led by the Chicago Zoological Society, with a geographically distributed consortium of nine partners: Columbus Zoo & Aquarium, Ohio; Como Zoo & Conservatory, Minnesota; Indianapolis Zoo, Indiana; Louisville Zoological Garden, Kentucky; Oregon Zoo, Oregon; Pittsburgh Zoo & PPG Aquarium, Pennsylvania; Roger Williams Park Zoo, Rhode Island; Toledo Zoological Gardens, Ohio, and the Polar Bears International.

The project's long-term vision focuses on the development of a network of U.S. zoos, in partnership with climate change domain scientists, learning scientists, conservation psychologists, and other stakeholders, that fosters changes in public attitudes, understandings, and behavior surrounding climate change. This vision was captured in the e-book *Climate Change Education: A Primer for Zoos and Aquariums* [\(Grajal](#)

1 and Goldman 2012). Much of this work has been continued by the NSF-funded National Network for  
2 Ocean and Climate Change Interpretation.<sup>4</sup>

### 3 4 **NSF, NOAA, and NASA Grant Collaboration**

5  
6 Since FY 2009, NSF has also participated in a multi-agency effort to coordinate U.S. government  
7 investments in climate change education through a collaboration with NOAA and NASA, which also  
8 have grant programs related to climate and environmental education. The three agencies now jointly  
9 convene annual meetings of the awardees of their respective grant programs—representing more than 120  
10 projects—to share insights, resources, tools, and strategies. This event has provided a crucial mechanism  
11 for coordination, and has enhanced learning among practitioners of climate change education at a range of  
12 levels.

### 13 14 **Climate Change Education Roundtable**

15  
16 To support and strengthen these education initiatives, and in response to a 2009 congressional mandate  
17 connected to NSF’s funding for a climate change education program, the National Research Council’s  
18 (NRC’s) Board on Science Education, in collaboration with the Committee on Human Dimensions of  
19 Global Change and the Division on Earth and Life Studies, created the Climate Change Education  
20 Roundtable.<sup>5</sup> The roundtable provides a forum for dialogue among practitioners and experts in multiple  
21 disciplines relevant to climate change education. It facilitates collaboration among federal agencies and

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<sup>4</sup> See [http://support.neaq.org/site/PageNavigator/prof\\_devel\\_study\\_circle.html](http://support.neaq.org/site/PageNavigator/prof_devel_study_circle.html).

<sup>5</sup> See [http://sites.nationalacademies.org/DBASSE/BOSE/CurrentProjects/DBASSE\\_072014#.UgTobfmR-So](http://sites.nationalacademies.org/DBASSE/BOSE/CurrentProjects/DBASSE_072014#.UgTobfmR-So).

private organizations, helping to promote unique contributions and align overall education strategies. Two NRC Roundtable reports provide significant input for this chapter:

- *Climate Change Education: Goals, Audiences, and Strategies: A Workshop Summary* (Forest and Feder 2013) and
- *Climate Change Education: Formal Settings, K-14: A Workshop Summary* (Beatty et al. 2013).

Table 9-1 at the end of this chapter presents an extensive listing of federal agencies' online, climate-relevant education resources.

### **Climate Literacy and Energy Awareness Network <sup>6</sup>**

CLEAN is an important community-based informal network of scientists, educators, policy makers, community leaders, students, and citizens who are engaged in fostering climate and energy literacy in the United States and abroad. CLEAN provides a forum for organizations, agencies, and individuals to collaborate for climate education. Members share ideas, coordinate efforts, promote policy reform, develop learning resources, and support integration of climate literacy into formal and informal education venues. Initiatives of CLEAN feature accurate scientific information, engaging learning experiences, and multiple formal and informal pathways to reach broad and diverse audiences.

National Efforts to Engage Americans on Climate Change

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<sup>6</sup> See <http://cleanet.org/clean/community/cln/index.html>.

1 Since the publication of the 2010 CAR, NGOs and federal, state, and local governments have conducted  
2 major communications campaigns to raise awareness and educate the nation about a variety of climate  
3 issues. As noted above, this chapter focuses on federal efforts, and is therefore not an exhaustive  
4 compilation of all of these actions.

### 5 6 **Connecting the Dots between Climate Change and Extreme Weather Events**

7  
8 The number of extreme U.S. weather events has increased over the last four years, presenting perhaps the  
9 most effective educational opportunities. In 2012, the nation was impacted by 11 individual weather and  
10 climate disasters with impacts of at least \$1 billion. Cumulatively, these 11 events resulted in more than  
11 \$110 billion in damages, 377 deaths, and directly affected major population centers like New York City  
12 and key industries, such as the agricultural sector.

13  
14 The impact of these events on the perceptions of climate change by Americans is described in the April  
15 2013 *Extreme Weather and Climate Change in the American Mind* report by Yale University and George  
16 Mason University (Leiserowitz et al. 2013). This report notes that 85 percent of Americans stated that  
17 they experienced one or more types of extreme weather in the past year. Additionally, 6 in 10 Americans  
18 (58 percent) believe global warming is affecting U.S. weather.

19  
20 Superstorm Sandy provides insights into how extreme events have increased Americans' eagerness to  
21 learn more about climate change and how the U.S. government has leveraged this interest. On October 25,  
22 2012, extratropical Hurricane Sandy struck the Mid-Atlantic states of New Jersey, New York,  
23 Connecticut, and Rhode Island. As a result, the national conversation regarding climate changed  
24 dramatically.



1  
2 The nations' educators and communicators have been working with federal Web portals—e.g., NOAA's  
3 Climate.gov,<sup>7</sup> NASA's Climate Portal,<sup>8</sup> EPA's Climate Change Portal,<sup>9</sup> EPA's Climate Change Indicators  
4 in the United States site,<sup>10</sup> and NGOs like Climate Nexus,<sup>11</sup> Climate Access,<sup>12</sup> and Climate Central<sup>13</sup>—to  
5 help citizens connect the dots between climate change and extreme weather events in scientifically correct  
6 and meaningful ways. As the extreme events continue to increase, these sorts of combined efforts will be  
7 needed to better serve the public's need for timely and trusted scientifically based information about how  
8 such extremes events may change in frequency or intensity in the future, and what people can do to  
9 prepare and become more resilient to their impacts.

### 10 11 **Capitalizing on Public Survey Research**

12  
13 During the past four years, numerous organizations and federal programs, have used public survey  
14 research on beliefs and attitudes from Yale University,<sup>14</sup> George Mason University,<sup>15</sup> and elsewhere to  
15 differentiate their climate and global change education and communication projects. As a result, these  
16 programs realize that people actively interpret information and construct their own mental models based

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<sup>7</sup> See <http://www.climate.gov/>.

<sup>8</sup> See <http://www.climate.nasa.gov/>.

<sup>9</sup> See <http://www.epa.gov/climatechange/>.

<sup>10</sup> See <http://www.epa.gov/climatechange/science/indicators/>.

<sup>11</sup> See <http://www.climatecensus.org/>.

<sup>12</sup> See <http://www.climateaccess.org/>.

<sup>13</sup> See <http://www.climatecentral.org/>.

<sup>14</sup> See <http://environment.yale.edu/climate-communication/>.

<sup>15</sup> See <http://www.climatechangecommunication.org/>.

1 on what they personally know, value, and feel. Using this research, the U.S. climate and global change  
2 communication and education community can be much more strategic in designing and implementing  
3 programs with limited resources.  
4

#### 5 **Developing Data-Driven, User-Friendly Web Sites**

6 To support growing public requests for meaningful and timely scientific information regarding climate  
7 and extreme weather, NOAA developed Climate.gov to provide climate data and information to help  
8 build a climate-smart nation. This user-friendly, online source of timely and authoritative scientific data  
9 and information about climate is designed to serve four segments of the public, including the science-  
10 interested public, scientists and specialists, formal and informal educators, and planners and policy  
11 leaders.  
12

13 Since the site's prototype launch in 2010, the Climate.gov Team has engaged in direct dialogues with data  
14 users and site visitors in the public and private sectors. The Web analytics from Climate.gov show  
15 significant visit spikes after each high-impact extreme event, similar to other climate change Web sites.  
16

17 In May 2013, Climate.gov was redesigned based on user feedback for each of the four main audiences.  
18 New data browse and access tools, such as the Global Climate Dashboard and the Integrated Map  
19 Application, make it easier for visitors to find and use climate data. The site's scope of contents has also  
20 expanded to serve hundreds of educational resources, decision-support tools, articles, and videos.  
21

#### 22 **Increasing Media Coverage** 23

[Insert image here]

Figure 9-1: 2004–2013 World Newspaper Coverage of Climate Change or Global Warming

In 2009, news media coverage of climate change increased substantially (Figure 9-1). Recent studies on the role of mass media in communicating climate science, mitigation, and adaptation have been mixed or more positive. The **Center for Science and Technology Policy Research**<sup>16</sup> at the University of Colorado has tracked media coverage of climate change since 2000. Researchers there saw a worldwide uptick across all media in 2012 in Europe, Asia, Africa, and South America and the five largest U.S. daily newspapers (Fisher 2013).

### **Developing Next-Generation Science Standards**

One of the most significant advances in K–12 climate change educational efforts is the Next-Generation Science Standards (NGSS) for teaching science in the United States.<sup>17</sup> Developed in collaboration with 26 states and several scientific organizations, these transformative guidelines for the first time recommend climate change as a core concept for U.S. science curricula, including an emphasis on anthropogenic or “human-caused” effects in both the middle and high school science standards.

In the next four years, significant work in educator professional development and curricular design is planned to support this critical advancement in the nation’s climate education. States across the nation have begun to adopt NGSS, which will improve overall climate literacy among all Americans, and build

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<sup>16</sup> See [http://sciencepolicy.colorado.edu/media\\_coverage/us/index.html](http://sciencepolicy.colorado.edu/media_coverage/us/index.html).

<sup>17</sup> See <http://www.nextgenscience.org/>.

1 in the next generation a firm foundation of knowledge and discourse as the nation faces decisions on how  
2 to best deal with a changing climate.

### 3 4 **Developing Future Climate Educators**

5  
6 Higher education also has a key role to play in developing graduates with the skills, background, and  
7 knowledge to meet the challenges presented by climate change. A recent 2010 report by the Association  
8 for the Advancement of Sustainability in Higher Education (AASHE) calls for “ensuring that all students  
9 in higher education have access to education for sustainability and opportunities to learn how to  
10 participate in and to lead the sustainability transformation” (AASHE 2010). Over the last 20 years,  
11 scholars, activists, and others have noted that through the research they conduct, their engagement with  
12 the broader community, and the operations they oversee, colleges and universities can serve as test sites  
13 and models for sustainable practices and societies. Where colleges and universities may have the largest  
14 impact, however, is with the students they educate.

15 Through the leadership of AASHE, ecoAmerica, Second Nature, and the American College & University  
16 Presidents’ Climate Commitment’s (ACUPCC’s) 665 signatory institutions, higher education is beginning  
17 to provide college and university graduates with the skills, background, knowledge, and habits of mind  
18 that will prepare them to meet the challenges presented by climate change. ACUPCC signatories continue  
19 their ongoing efforts to publicly report on progress made to eliminate operational GHG emissions and to  
20 provide the education, research, and community engagement to enable the rest of society to do the same.

21  
22 The ACUPCC Reporting System allows signatories to track, assess, and communicate progress to their  
23 campus community and beyond, demonstrating to prospective students, foundations, and potential  
24 private-sector partners that their institution is serious about its commitment to climate change and  
25 sustainability. Since the last data summary in June 2012, the number of Progress Reports on Climate  
26 Action Plans has increased from 240 to 306, providing significantly more data to draw from and  
27 demonstrating continued growth in climate and sustainability action.

28  
29 To date, 68 percent of the 306 institutions that submitted a Progress Report have affirmed that their  
30 Climate Action Plan has helped them realize significant financial savings, include \$119 million in savings  
31 from implemented projects. Another 137 signatories reported that they have secured funding from outside  
32 resources totaling more than \$305 million to implement climate and sustainability efforts. ACUPCC  
33 signatories are building institutional capacity to foster career preparedness for their students through

1 curriculum development, securing funding for and from climate and sustainability efforts and advancing  
2 innovation through institutional research.<sup>18</sup>

3 [Insert image here]

4 Figure 9-2: American College & University Presidents' Climate Commitment from the University of  
5 Maryland

6  
7 UMD was selected as a Maryland Energy Administration Project Sunburst Initiative Partner and awarded  
8 a grant aimed at promoting the installation of renewable energy systems on public buildings in  
9 Maryland.<sup>19</sup> This photo shows a part of the Severn Solar Array<sup>20</sup> with more than 2,600 solar panels  
10 installed in 2011.

### 11 **Audience Segmentation Strategies**

12 The United States is using audience segmentation to prioritize strategies for communication and  
13 education about climate change, as demonstrated in the report *Climate Change Education: Goals,*  
14 *Audiences, and Strategies: A Workshop Summary* (Forest and Feder 2013). One of the key steps in  
15 ensuring the effective use of communication and education practices is to know the audience—who they  
16 are, what they already know, how they learn, and their preferred methods of communication and or  
17 education.  
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19

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<sup>18</sup> See more at <http://www.secondnature.org/blog/2013-04-04/second-nature-applauds-unprecedented-progress-made-signatories#sthash.SiBUHXe2.dpuf>.

<sup>19</sup> See <http://www.flickr.com/photos/sustainableumd/8476036775/in/set-72157632771609807>.

<sup>20</sup> See <http://www.sustainability.umd.edu/content/campus/energy.php>.

Studies have found that different audiences have different information gaps and misconceptions and want to know different things. To this end, U.S. federal, state, and NGO programs have identified high-priority audiences like formal educators, informal educators (e.g., weather forecasters), and decision makers. This outreach helps convey clear and concise information through appropriate communication and education channels. Following are some examples of programs using audience segmentation.

#### **NOAA Climate.gov portal**

The NOAA Climate.gov portal used an audience-focused approach to refine its design, enhance its functionality, and expand its scope of contents in response to user feedback. NOAA defines the “public” is as any nongovernmental segment of society that can be characterized by its specific need for climate information and services, and its information-seeking behaviors. NOAA’s Climate Literacy Objective targets six priority publics: (1) decision makers and policy leaders, (2) scientists and applications-oriented data users, (3) educators, (4) students and lifelong learners, (5) journalists and TV meteorologists, and (6) the climate-interested public.

#### **National Wildlife Federation**

The National Wildlife Federation (NWF) engages leaders in influential communities as voices for both personal and civic actions on climate and broader policy reforms (Coyle 2010). From 2007 to 2010, NWF trained 5,000 leaders in climate education from selected constituent groups. The training programs reflected lessons learned from a previous effort focused on hunters and anglers. Based on this success, NWF staff used survey research to identify and develop training aligned with the cultural sensitivities, conceptual frames, and informational needs of several other constituencies. Training was targeted to the unique interests and concerns of environmental and civic activists, master gardeners, conservative faith-based organizations, watershed conservationists, land trust leaders, birders, university groups, coastal wetland conservation organizations, and business leaders.

#### **Interfaith Power and Light**

Interfaith Power and Light (IPL), the largest faith-based climate change organization in the United States, works with more than 10,000 congregations in 38 states. The community of faith-based organizations is growing to include the National Religious Partnership for the Environment, the National Council of Churches Eco-Justice Programs, the Evangelical Environmental Network, and the Coalition on the

1 Environment in Jewish Life. IPL has identified several key barriers to the acceptance of climate change  
2 information in faith-based audiences. State directors of IPL also reported success across audiences using  
3 messages framed in terms of certain values, including stewardship and eco-justice.  
4

#### 5 **Center for Climate and Energy Solutions'**

6  
7 The Center for Climate and Energy Solutions' (C2ES) primary mission is to engage the business  
8 community on climate change issues, providing credible information and workable solutions. C2ES  
9 places importance on framing appropriate messages. C2ES programs have found that although climate  
10 change remains a polarizing issue in the United States, there are ways to communicate effectively about  
11 the challenges and engage government, business, and individuals in finding solutions. C2ES has found  
12 that peer-to-peer learning is very effective for climate change education.  
13

14 Effective education and communication efforts directed toward the public and decision makers are  
15 interactive and ongoing. Effective programs allow for feedback of shared knowledge, provide a forum for  
16 sustained discussions of climate change impacts, and build trust between the public and decision makers.  
17 Decision makers reflect community values, needs, and interests. Recent U.S. climate education,  
18 communication, training, and engagement allow the public and policy makers to engage in a dialogue in  
19 which all viewpoints are understood and considered.  
20

#### 21 **FEDERAL AGENCY EDUCATION, TRAINING, AND OUTREACH PROGRAM OVERVIEWS**

22  
23 A significant number of federal agencies provide state and local governments, industry, NGOs, and the  
24 public with information about national and global climate change research and risk assessments studies,  
25 U.S. mitigation activities, and policy developments. They work both independently and in partnership  
26 with other agencies, NGOs, and industry toward the common goal of increasing awareness and  
27 understanding about the potential environmental and societal challenges posed by climate change and  
28 opportunities for solutions. As President Obama said in the June 25, 2013, release of his Climate Action  
29 Plan: "We've got to look after our children; we have to look after our future; and we have to grow the  
30 economy and create jobs. We can do all of that as long as we don't fear the future; instead we seize it  
31 (EOP 2013)."  
32

#### 33 **U.S. Global Change Research Program**

USGCRP is responsible for communicating with a variety of stakeholders nationally and globally on issues related to climate variability and climate change science, and for coordinating the federal agencies' climate change communications and education programs. The Communications and Education Interagency Working Group leads efforts to coordinate interagency education and communications activities.

## **U.S. Department of Commerce**

### **National Oceanic and Atmospheric Administration**

NOAA is committed to the development of a society that is environmentally responsible and utilizes effective, science-based problem-solving skills. NOAA recognizes that improvements in societal stewardship of natural resources extend directly from effective stakeholder engagement, training, extension, and formal and informal education systems.

NOAA's climate education programs support the development of strong and comprehensive education materials about climate and oceanic and atmospheric sciences. NOAA works to facilitate a formal education system that produces climate literate citizens by engaging participation from policymakers, academic institutions, professional associations, teachers, and students.

In addition, informal education plays a critical role in developing climate-literate citizens. To help equip informal education institutions with modern instructional resources and interdisciplinary methods for teaching Earth system science, NOAA partners with aquarium, zoo, national park, national marine sanctuary, national estuarine research reserve, and National Sea Grant colleges. NOAA also works with other informal science education centers addressing climate change through the [Climate Interpreter Network](#) that has been funded by the Institute of Museum and Library Services, NOAA, and NSF. NOAA is engaged in the improvement of both formal and informal education systems because these venues are important to the development of literate citizens and to the long-term maintenance of their skills, knowledge, and attitudes. Partnerships and collaboration are integral to sustaining and scaling up NOAA's ability to promote public climate literacy.



1  
2 NOAA's Regional Integrated Science and Assessments (RISA) program and the National  
3 Integrated Drought Information System (NIDIS) supports research teams that help expand and  
4 build the nation's capacity to prepare for and adapt to climate variability and change. Central to  
5 the RISA and NIDIS approaches are commitments to process, partnership, and trust building  
6 with the goal of translating science into actionable knowledge and increasing capacity for  
7 making decisions in a rapidly changing environment. As societal awareness of climate risk  
8 grows, climate information is being infused into public spheres in richer ways, placing more  
9 emphasis on innovation of different methods for providing actionable knowledge. The dialogue  
10 between scientists and stakeholders also provides the perfect setting for social scientists and  
11 outreach experts to evaluate how well science is informing societal outcomes. RISAs NIDIS  
12 work closely with applied scientists who provide predictions and projections of weather and  
13 climate, with cooperative extension and outreach professionals, and communications experts.  
14

15 NOAA addresses the growing societal challenges and need for enhanced information products  
16 and services through integrated research, monitoring and services development, including  
17 regional climate assessments, early warning information systems, and training and education  
18 activities.  
19

## 20 21 **U.S. Department of Energy**

### 22 23 **Global Change Education Program**

24  
25 The U.S. Department of Energy (DOE) sponsors the Global Change Education Program (GCEP) to  
26 promote undergraduate and graduate education and training in support of global change research  
27 activities. GCEP has two components: the Summer Undergraduate Research Experience and the Graduate  
28 Research Environmental Fellowships.  
29

30 Global change research encompasses a number of technical areas, including atmospheric sciences,  
31 ecology, global carbon cycles, climate, and terrestrial processes. DOE's Office of Science supports global  
32 change research through its Biological and Environmental Research, Atmospheric Systems Research,

1 Terrestrial Carbon Cycle Processes, and for Ecosystem Research programs DOE also supports studies  
2 addressing climate modeling, integrated assessments, predictions, and policy, as well as Earth system  
3 processes.  
4

5 GCEP is involved in climate change educational outreach in communities and regions hosting  
6 atmospheric radiation measurement (ARM) data-gathering field sites. GCEP also provides educational  
7 resources to a global audience through the ARM Web site.<sup>21</sup> The goal of the program is to develop basic  
8 science awareness and increase critical thinking skills, focusing on environmental science and climate  
9 change for K–12 students. In addition, the program supports relationship building among teachers,  
10 students, scientists, and the community. Lesson plans, puzzles, and related materials are made available at  
11 the Web site. The site’s “Ask a Scientist” interface provides the opportunity for visitors to pose questions  
12 to ARM scientists, and posts both questions and answers.  
13

#### 14 **U.S. Department of Health and Human Services**

##### 15 **CDC and NIEHS**

16  
17 Climate change information, education, and outreach from the U.S. Department of Health and Human  
18 Services (HHS) center around impacts of climate change on human health, with a particular focus on  
19 vulnerable populations. These activities are primarily coordinated through programs at the Centers for  
20 Disease Control and Prevention (CDC) and the National Institute of Environmental Health Sciences

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<sup>21</sup> See <http://education.arm.gov>.

(NIEHS). CDC's program is aimed at state and local public health departments, and NIEHS serves the education and research communities.

Both institutions, along with The National Library of Medicine, also maintain Web sites with climate change and health information links designed for use by the general public. NIEHS also serves as the HHS principal to the USGCRP and, along with CDC and NOAA, co-leads USGCRP's Climate Change and Human Health Working Group, through which many interagency communications and outreach activities are planned and implemented.

## **U.S. Department of the Interior**

DOI has an integrated climate change research and adaptation strategy for itself and its agencies. DOI agencies include its research arm, the U.S. Geological Survey (USGS), and land- and resource-managing agencies, such as the National Park Service (NPS), U.S. Fish and Wildlife Service (FWS), Bureau of Land Management (BLM), Bureau of Reclamation (BOR), Bureau of Indian Affairs (BIA), Bureau of Ocean Energy Management (BOEM), and related agencies and offices.

DOI's climate strategy has a hub and spokes, with the hub located in the USGS National Climate Change and Wildlife Science Center, and the spokes located in the eight regional DOI climate science centers (CSCs) set up since 2010. The CSCs are operated in conjunction with universities in each U.S. region of the United States. In addition to advising land managers about research related to their regions, the CSCs coordinate with 22 landscape conservation cooperatives (LCCs) composed of landowners near our U.S. parks, refuges, and other lands; government officials at the federal, state, and local levels; tribal leaders; and nonprofit and citizens' groups.

DOI, its bureaus, and CSCs and LCCs maintain climate Web pages and sites as well as create social media, press releases, and publications related to climate change. In addition, parks and refuges have public education programs.

## **National Park Service**

NPS manages 3.4 million hectares (ha) (84 million acres [ac]) of land, including more than 400 national parks and other units, almost a million historic structures and archeological sites, thousands of miles of rivers and 69,463 kilometers (43,162 miles) of shoreline. Because some of America's greatest wildlands,

1 wildlife, and cultural treasures are especially vulnerable to climate change, the NPS considers it one of the  
2 agency's greatest challenges.

3  
4 The NPS *Climate Change Action Plan: 2012–2014* builds on a strategy released in 2010, stating that by  
5 articulating “a set of high-priority, no-regrets actions the NPS is currently undertaking or committed to  
6 undertake, in the next one to two years” to help park managers and staff effectively plan for and respond  
7 to climate change (U.S. DOI/NPS 2010). Near-term priorities include enhancing workforce climate  
8 literacy; engaging youth and their families in climate change research, education, and hands-on projects;  
9 providing climate change science in parks; implementing a *Green Parks Plan* (U.S. DOI/NPS 2012);  
10 applying appropriate adaptation tools and options; and strengthening communication with the public  
11 within the “natural classrooms” in the parks and through a wide variety of interpretive and educational  
12 media.

13  
14 Between 2007 and 2012, NPS held 17 workshops to train park managers on scenario planning. In  
15 addition, NPS's Climate Change Response Program has provided climate change-related training to NPS  
16 staff since 2007. Over the longer term, NPS planning is flexible to adapt to ongoing and emerging  
17 developments, such as climate change research, new advances in media and technology, and extreme  
18 events and disasters.

## 19 **U.S. Fish and Wildlife Service**

20  
21  
22 FWS administers the U.S. wildlife conservation laws, monitors and manages migratory birds, restores  
23 nationally significant fisheries, conserves wetlands, and regulates international wildlife trade. FWS also  
24 manages the 96-million-acre National Wildlife Refuge System. All of these responsibilities require  
25 preparation for climate change and adaptation contained in the FWS climate strategy.

26  
27 In addition, FWS has taken the lead in setting up the interagency LCCs that work in conjunction with the  
28 CSCs. These cooperatives address the challenges that are too great for any single national wildlife refuge,  
29 national park, or other community to manage alone—such as drought, climate change, and large-scale  
30 habitat fragmentation. The 22 LCCs work together on mutual conservation goals, benefitting from  
31 scientific and technical expertise beyond the reach of any one group.

32  
33 FWS also co-led development of the March 2013 *National Fish, Wildlife and Plants Climate Adaptation*  
34 *Strategy* (U.S. DOI/FWS 2012). This is the first nationwide strategy to help public and private decision  
35 makers address the impacts that climate change is having on wildlife and other natural resources and the

1 people and economies that depend on them. Development of the strategy was guided by an innovative  
2 partnership of federal, state, and tribal fish and wildlife conservation agencies in response to a 2010 call  
3 by the U.S. Congress for a national, government-wide climate adaptation strategy to assist fish, wildlife,  
4 and plants, and related ecological processes in becoming more resilient, adapting to, and surviving the  
5 impacts of climate change.

6  
7 The partnership was co-led by FWS, the Department of Commerce's NOAA , and the New York State  
8 Department of Environmental Conservation (representing state fish and wildlife agencies). An  
9 intergovernmental steering committee that included representatives from 15 federal agencies, five state  
10 fish and wildlife agencies, and two inter-tribal commissions oversaw development of the strategy, with  
11 extensive public input and support from the Association of Fish and Wildlife Agencies.

## 12 13 **U.S. Geological Survey**

14 USGS is a multidisciplinary science arm of the U.S. government that undertakes scientific research,  
15 monitoring, remote sensing, modeling, synthesis, and forecasting that address the effects of climate and  
16 land-use change on the nation's resources. The resulting research and products are provided as the  
17 scientific foundation upon which policy makers, natural resource managers, and the public make  
18 informed decisions.

19  
20 USGS runs the National Climate Change and Wildlife Science Center, which provides scientific and  
21 technical support to other agencies on the impacts of climate change. USGS also helped DOI establish  
22 the CSCs.

23  
24 The USGS Land Remote Sensing Program operates the Landsat satellites (which are built and launched  
25 by NASA) and provides the nation's portal to the largest archive of remotely sensed land data in the  
26 world. These images serve many purposes, including tracking climate change. In addition, the Earth  
27 Resources Observation and Science Center contributes to USGS's climate and land-use programs with  
28 basic and applied research, data acquisition, systems engineering, and information access and  
29 management. USGS also conducts research to assess the potential capacities and limitations of various  
30 forms of carbon sequestration.

## 31 32 **Bureau of Land Management**

BLM manages more than 9.9 million ha (245 million ac) of public land for a wide variety of uses, including conservation, energy development, and recreation. Most of this land is found in the West, where average temperatures are rising, droughts are increasing, snowpack is declining, water supplies are diminishing in key areas, and wildfires have become larger and more frequent. BLM is undertaking two connected initiatives to understand, anticipate, and respond to the effects of climate change on the public lands: Rapid Ecoregional Assessments, which are currently being prepared, and a landscape approach for managing public lands.

#### **Bureau of Reclamation**

BOR provides research on the effects of climate change on water supplies that is useful to water managers and decision makers. The WaterSMART program, provides grants and other tools to help communities improve climate analysis tools and stretch water supplies through various conservation and water recycling projects. The WaterSMART Clearinghouse provides water resource planners and managers with tools related to water conservation and sustainability, arranged by term, topic, state, river basin, or tribal area.

#### **U.S. Department of Transportation**

DOT has developed many programs to educate the public, government employees, state and local agencies, and other transportation stakeholders about climate change.

#### **Federal Transit Administration**

FTA has several programs that provide information about the benefits of public transit and how to reduce the environmental impacts of transportation. The Environmental Management Systems Training, in particular, offers training for public transit agencies to assess and reduce the environmental impacts of their operations, including their carbon footprint.

FTA organizes, sponsors, and participates in numerous conferences as part of FTA's outreach efforts, including conferences and sessions geared toward education on environmental and climate change issues. In the last year, FTA sponsored and participated in climate change panels at the annual Transportation

1 Research Board conference, the Rail-volution conference, the American Public Transportation  
2 Association sustainability workshop, and the New Partners for Smart Growth Conference.

3  
4 Funded by FTA, the National Transit Institute (NTI), at Rutgers, The State University of New Jersey, was  
5 established under the Intermodal Surface Transportation Efficiency Act of 1991 to provide training,  
6 education, and clearinghouse services in support of public transportation and quality of life in the United  
7 States. NTI courses on transportation planning, environmental review, transit-oriented development, and  
8 transportation and land use are particularly relevant to climate change issues.

9  
10 FTA's climate change adaptation initiative Web page provides the public and transit agencies with  
11 information on FTA efforts with regard to climate change adaptation; published reports, policy  
12 statements, and letters; past events and workshops focusing on transit adaptation to climate change; and  
13 current activities taking place (including information on the seven FTA climate adaptation pilot projects).

#### 14 15 **Federal Highway Administration**

16  
17 FHWA targets metropolitan planning organizations (MPOs) and local transportation agencies to provide  
18 information on their climate science and mitigation strategies. Recently FHWA unveiled the Energy and  
19 Emissions Reduction Policy Analysis Tool (EERPAT). FHWA developed EERPAT for use by state  
20 DOTs to model a large number of inputs and policy scenarios to support strategic transportation and  
21 visioning, including GHG emission reduction alternatives. EERPAT can be used to assist state DOTs in  
22 analyzing GHG reduction scenarios and alternatives for use in the transportation planning process,  
23 climate action plans, scenario planning exercises, and meeting state GHG reduction targets and goals.  
24 FHWA has also developed a Mitigation Reference Sourcebook to accompany the tool, which describes  
25 the strategies, estimates the potential range of GHG reductions, estimates costs, identifies barriers to  
26 implementation, identifies example projects, and describes any associated co-benefits or disadvantages  
27 (Kalra et al. 2012).

28  
29 More recently, FHWA is planning to host peer exchanges for information sharing between 19 climate  
30 resilience pilots at state DOTs and MPOs. Previously, between June 2011 and April 2012, FHWA  
31 convened three peer exchanges for transportation agencies to share information related to climate change  
32 mitigation activities. These efforts are in addition to a DOT-wide effort to educate federal and state  
33 employees about a variety of transportation and climate change issues. For example, the Transportation

1 and Climate Change Clearinghouse Web site, a one-stop source of information on transportation and  
2 climate change issues, includes information on GHG inventories, analytic methods and tools, GHG  
3 reduction strategies, potential impacts of climate change on transportation infrastructure, and approaches  
4 for integrating climate change considerations into transportation decision making.

## 5 6 **National Aeronautics and Space Administration** 7

8 NASA supports extensive education, training, and public awareness on climate change that take  
9 advantage of NASA's capabilities of observing the Earth system from space. In addition to programs  
10 targeted at training at the graduate and early-career levels, NASA is committed to building partnerships in  
11 communication and education to effectively reach various segments of the public.

12  
13 The Global Learning and Observations to Benefit the Environment (GLOBE) program, jointly sponsored  
14 by NASA and NSF, continues to support teachers and students to conduct hands-on research projects  
15 about their local environment across 109 countries worldwide.<sup>22</sup> The NASA Innovations in Climate  
16 Education project offers opportunities to educational institutions in climate education.<sup>23</sup> Through Earth to  
17 Sky, NASA also works with interpretation experts at NPS, FWS, BLM, and other agencies, to connect the  
18 wonder of science with the power of place by providing relevant and integrative information about  
19 climate change to the public.<sup>24</sup> Finally, NASA participates in public events and engages the public online,  
20 to promote broader understanding of climate change and its impacts on society.<sup>25</sup>

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<sup>22</sup> See <http://www.globe.gov>.

<sup>23</sup> See <http://gcce.larc.nasa.gov/>.

<sup>24</sup> See <http://earthtosky.org/>.

<sup>25</sup> See, for example, <http://climate.nasa.gov>, <http://earthobservatory.nasa.gov>, social media.



**National Science Foundation**

Consistent with its mission to support research and education across a broad range of science and engineering disciplines, NSF funds research in numerous areas related to global climate change. NSF's Directorates for Geosciences; Biological Sciences; Social, Behavioral, and Economic Sciences; Education and Human Resources; Mathematics and Physical Sciences; Computer and Information Science and Engineering; and the former Office of Polar Programs (recently merged with Geosciences) participate in the USGCRP and provide access to climate-related results from principal investigators.

NSF is the principal federal agency charged with promoting science, technology, engineering, and math education. To this end, NSF supports the development of a diverse and well-prepared scientific and technical workforce, and a scientifically literate citizenry.

**Smithsonian Institution**

The Smithsonian is addressing the global challenge of climate change with special exhibitions and ongoing research. Smithsonian collections related to the evidence about, the impacts of, and response to climate change provide a unique and accessible resource for public education. Smithsonian scientists and curators regularly engage the museums' visitors with evidence about climate change issues, from the perspectives of science, history, and art.

**U.S. Agency for International Development**

As a the foreign assistance arm of the U.S. government, USAID plays a leadership role in delivering climate change-related international assistance to more than 40 developing and transition countries. With headquarters in Washington, D.C., USAID has field offices in many regions of the world—namely, sub-Saharan Africa, Asia, the Middle East, Latin America and the Caribbean, and Europe and Eurasia. USAID works in close partnership with private voluntary organizations, indigenous groups, universities, American businesses, international organizations, other governments, trade and professional associations, faith-based organizations, and other U.S. government agencies.

USAID's foreign assistance work incorporates climate change considerations into development projects, supporting on-the-ground programs to achieve climate change results and strengthen economic growth. Climate change education, training, and outreach are a cornerstone of USAID's activities, providing the

1 foundation for sustainable actions. Capacity building for improved decision making through applied  
2 science and access to information is increasingly important. (This work is highlighted in Chapter 7.)  
3 Building on clean energy, sustainable landscapes, and adaptation strategies, USAID will continue to  
4 integrate education, outreach, and training into its development mission to contribute to reducing the  
5 threat of climate change around the world.

## 7 **U.S. Department of Agriculture**

### 9 **Agricultural Research Service**

10 As USDA's chief intramural scientific research body, the Agricultural Research Service (ARS) is  
11 responsible for research on the impacts of agricultural practices on potential climate change or disruptions  
12 and vice versa. Although ARS has no formal educational mechanism to disseminate research information  
13 to the general public, it employs a number of less formal means to communicate and make use of research  
14 advances. All USDA scientific research publications are submitted with an Interpretive Summary that is  
15 used for timely news releases. In addition, through collaboration with university scientists, climate change  
16 research information is provided to state and county cooperative extension agencies for release to  
17 identified producers. Also, all USDA field locations publish informative brochures and technical reports  
18 that describe their work and the impact of the research findings on stakeholders' interests.

### 19 **National Institute of Food and Agriculture**

20  
21 Established by the Food, Conservation, and Energy Act of 2008, NIFA replaced the former Cooperative  
22 State Research, Education, and Extension Service, which had been in existence since 1994. NIFA is the  
23 primary USDA agency that supports extramural research, extension, and education activities by providing  
24 competitive and capacity funds in such areas as agriculture and natural resources science for climate  
25 variability and change. The NIFA Coordinated Agricultural Project awards support projects to deliver the  
26 best tools available to accurately measure and respond to the effects of climate, and better understand how  
27 to work with and educate farmers, landowners, and foresters about regional climate change issues.  
28 Through federal funding and leadership for research, education, and extension programs, NIFA focuses  
29 on investing in science and solving critical issues affecting people's daily lives and the nation's future.

### 31 **Climate Change Research Centers**

32  
33 Similar to DOI's and NOAA's regional climate centers strategy, the new USDA climate change research  
34 centers have a stated mission to educate the public about regional climate change issues.

**U.S. Forest Service**

USFS national efforts in climate change education, training, and public awareness are based on the scientific expertise and findings of the agency's more than 500 scientists. The USFS Research and Development program conducts research investigating how climate change is and may be affecting terrestrial and freshwater natural resources and ecosystems. These results are made available to professional resource managers and the public through a variety of Web sites and publications.

USFS also provides climate change education resources to educators and students through a variety of programs. One of these is *The Natural Inquirer*, a science education journal based on published USFS science, targeted for U.S. and international middle school students. Climate change editions of *The Natural Inquirer* have focused on contemporary research findings regarding climate change and wildfires and the impact of a changing climate on wildlife and stream temperatures.

In its most recent project, USFS has partnered with 18 other agencies and organizations to offer ClimateChangeLIVE,<sup>26</sup> a distance learning adventure. This project brings climate learning through a series of science-based, televised webcasts, webinars, and online climate education resources. In addition, EUGENE (Ecological Understanding as a Guideline for Evaluation of Nonformal Education)<sup>27</sup>—a broadly applicable, user-friendly Web-based environmental education evaluation instrument that assesses student knowledge on limits, regulation, and adaptation related to climate change—will assist educators

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<sup>26</sup> See <http://www.climatechangelive.org/>.

<sup>27</sup> See <https://projecteugene.org/cgi-bin/eugene>.

1 in the evaluation and improvement of their climate change programs and will increase accountability in  
2 climate change education.

#### 4 **U.S. Environmental Protection Agency**

5 Climate change information, education, and outreach at EPA are an important part of EPA's work. EPA  
6 maintains a Climate Change Web site and a Student's Guide to Climate Change Web site, and has  
7 produced educational and informational materials that reach a wide range of audiences. In addition, EPA  
8 provides outreach programs that educate decision makers and the public about opportunities to reduce  
9 GHG emissions and adapt to the impacts of climate change that humans and nature are already facing.

10  
11 EPA also runs a grant program that distributes more than \$3 million a year to formal and informal  
12 education programs across the country that educate learners of all ages about the reasons for and ways to  
13 solve environmental problems. For the last several years, a significant percentage of those funds went  
14 specifically to climate change education programs.

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